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PRE-SERVICE TEACHERS ASSESSMENT OF STUDENT LEARNING IN SCIENCE EDUCATION

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ABSTRACT: *This paper was conducted to examine the tools, strategies, and problems encountered in assessing student learning by pre-service teachers in science during their on-and-off campus clinical experience. A explanatory sequential mixed method design (Creswell, 2003) was used in this study. Three research-made instruments were used in this study: The Assessment Checklist for Student Teachers in Science, Focus Group Discussion (FGD) Questions, and the In-depth Interview Questions. There were 17 pre-service teachers participated from a teacher education institution. Findings of the study using Kruskal-Wallis One-way Analysis of Variance and Thematical Analysis using Phenomenological Reduction Method revealed the assessment tools used most frequently and least frequently, assessment strategies, and the problems encountered by pre-service teachers in science in assessing student learning. The findings also revealed that there was a significant difference in the use of rubric (p value=0.045) as the least frequently used assessment tool by pre-service teachers in science when grouped according to specialization.*

KEYWORDS: Assessment, Pre-Service Teachers, Science Education, Sequential Explanatory, and Student Learning

INTRODUCTION

Background or Context of the Study

An important goal of science education is to help students construct knowledge concerning scientific phenomena and, at the same time, help them to reason, think critically, and solve problems. Few would contest the claim that science education has traditionally been dominated by the transmission of accepted knowledge as the principal teaching mode and factual recall as the main means of assessment (Wellington, 1989).

Assessment is a process aimed at understanding and improving student learning. It involves making teacher expectations clear to students and setting appropriate outcomes for learning. It helps to determine how well student performance matches those outcomes. It uses the resulting information to improve student learning. Teachers gather information on student learning through tests, performance tasks, worksheets, checklists, watching and listening to students, and so on. By emphasizing multiple means of collecting student data on a variety of variables assessment goes beyond mere testing.

As teachers, we are continually faced with the challenge of assessing the progress of our students as well as our own effectiveness as teachers. Assessment decisions could substantially improve student performance, guide the teachers in enhancing the teaching-learning process and assist policy makers in improving the educational system. As expected, the teacher being

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the one directly involved in the teaching-learning process, has been the object of criticism. One popular belief is that poor qualities of teachers are the cause of deterioration in education. It is very possible then that the teachers may not have the right or sufficient preparation that would make them effective facilitators of learning.

Why Study Assessment of Student Learning in Science Education?

This study serves as reference to pre-service teachers in Science to determine the effective tools and strategies in assessing students' learning. The result may serve as a feedback to pre-service teachers in science as to whether science majors of any Teacher Education Institution were taught of tools and strategies that help promote the Assessment of Student Learning of their pre-service teachers in science.

Research Purpose and Questions

The purpose of this study was to examine the tools, strategies and the problems encountered by pre-service teachers in science during their on-and-off-campus clinical experience.

The study was guided by four questions:

1. What assessment tools are most frequently and least frequently used by student teachers in assessing student learning in science in a week when taken as an entire group and when grouped according to specializations?
2. Is there a significant difference in the assessment tools that are most frequently and least frequently used by student teachers in assessing student learning in science when grouped according to specialization?
3. How do assessment tools contribute to the grades of students?
4. What problems did student teachers encounter in assessing student learning?

Hypothesis

Based on the preceding questions, the following null hypothesis is advanced.

1. There is no significant difference in the assessment tools that are most frequently and least frequently used by student teachers in assessing student learning in science when group according to specialization.

Conceptual Framework of the Study

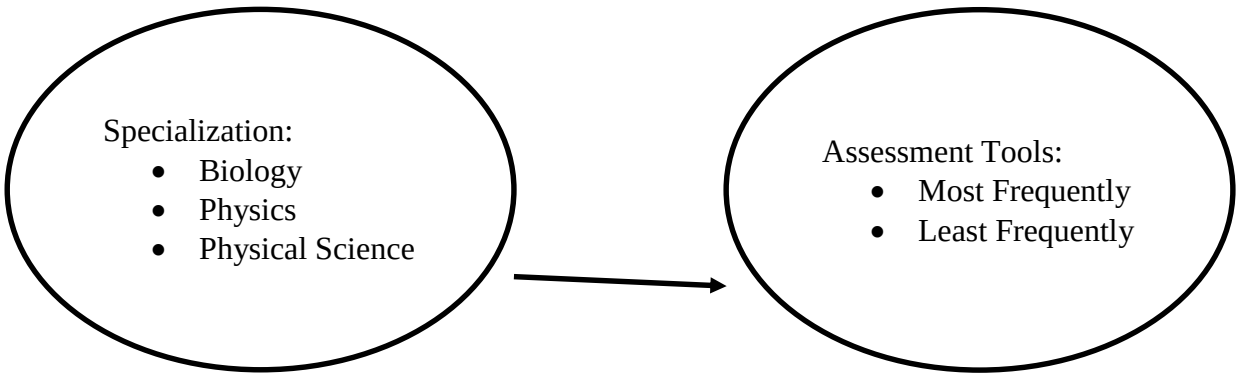

Figure 1. Conceptual framework

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Assessment tools/ Assessment strategy utilized by pre-service teachers in science to measure student's learning, contribute to students' grades, and determine problems encountered in assessing student learning.

Theoretical Underpinning

As a descriptive-interpretative study, this research was founded on the epistemology of objectivism and post-positivism as the theoretical research perspective. Objectivism is the epistemological view that things exist as meaningful entities independently of consciousness and experience, that they have truth and meaning residing in them as objects and that careful research can attain that objective truth and meaning (Crotty, 1998). This is the epistemology underpinning the post-positivist stance. Post-positivism is not trying to substitute a more secure and firm foundation as an alternative to positivism (Lather, 1991). Rather, it strives to 'produce an awareness of the complexity, historical contingency and fragility of the practices that we invent to discover the truth about ourselves' (Lather, 1991). It is thus much more than 'post' – it is actually extra-positivist, because it provides vantage points from outside positivism, from which the researcher can approach research. In everyday reasoning, post-positivist researchers do not see themselves as inevitably solving the problems they set out to investigate. Scientific reasoning and common sense reasoning are essentially the same process. Post-positivism paradigm and sequential explanatory method go together.

Holt and Willard-Holt (2000) emphasize the concept of dynamic assessment that differs significantly from conventional tests. It is a way of assessing the true potential of learners. Here the essentially interactive nature of learning is extended to the assessment process. Rather than viewing assessment as a process carried out by one person, such as an instructor, it is seen as a two-way process involving interaction between instructor and learner. The role of the assessor becomes one of entering into dialogue with the persons being assessed to find out their current level of performance on any task and sharing with them possible ways in which that performance might be improved on a subsequent occasion. Thus, assessment and learning are seen as inextricably linked and not separate processes (Holt and Willard-Holt 2000).

An explanatory sequential mixed method design was used in this study that appeals to individuals with a strong quantitative background or from fields relatively new to qualitative approaches (Creswell, 2014). This mixed method was used to illuminate the need to better understand the nature of assessing student learning in science education by pre-service teachers. Taken as a whole, there is a need for further empirical research on the tools, strategies, and problems encountered in assessing student learning. In particular, there was a dearth of mixed methods studies that seek to explain the assessment of student learning by pre-service teachers in science found in recent quantitative or qualitative research. This research study provides empirical results which fill this gap in the literature.

METHODOLOGY

The purpose of this research study was to explore the role the school leader plays in students' mathematics achievement through the lens of complexity theory using an explanatory sequential mixed methods design (Creswell & Plano Clark, 2011). In the quantitative data collection phase of the study, the researcher collected survey data from K-12 traditional public and public charter school leaders throughout the state of Utah to assess whether school leader characteristics related to students' mathematics achievement. The researcher collected the

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quantitative data over the course of two months. During the qualitative data collection phase, the researcher explored the school leaders' role through three focus groups consisting of 5-6 school leaders each. The focus groups included school leaders from schools performing higher than their demographics would suggest, school leaders from schools performing about where their demographics would suggest, and school leaders from schools performing lower than their demographics would suggest. The researcher collected the qualitative data over the course of 2 months.

The explanatory sequential methods design were used in this study to examine the assessment of pre-service teachers in assessing student learning in science. The sampling design used in this study was the purposive sampling technique. The participants of the study were seventeen (17) secondary pre-service science teachers (6 participants from Physics majors, 8 participants from the Biology majors and 3 participants from the Physical Science major) of a Teacher Education Institution in the Philippines.

The sampling for the study was "purposeful" (Patton, 2002) and also "theoretical". The researcher chose the study because of his interest on how pre-service teachers assess students' learning in science. Nevertheless these seventeen (17) pre-service teachers in science have helped and contributed much to the success of the drawing of funds of knowledge.

This study started when the researcher asked permission from the proper authorities to conduct the study. The first instrument was given after the first grading examination of the students. The participants were instructed how to answer the first instrument (Assessment tools checklist for Student Teachers in Science) which was a survey. After 15 minutes, the researcher gathered the instrument, checked it and analyzed the results. After analyzing the result of the first instrument the researcher developed an interview questionnaire from the result of the first instrument. The next step was distribution of consent form. The researcher conducted an interview for the Focus Group Discussion using the formulated guide question from the first instrument. It was conducted during the vacant time of the participants. The researcher transcribed the interviews to gather data. After having the Focus Group Discussion or FGD, the researchers conducted an in-depth interview with the participants for more reliable data on how they assess student learning in science.

RESULTS AND DISCUSSION

Findings of the study using Kruskal-Wallis One-way Analysis of Variance and Thematic Analysis using Phenomenological Reduction Method revealed that pre-service teachers in science used (a) identification as the "Most frequently", and (b) portfolio, journals, and checklist as the "Least frequently" used assessment tools in a week when taken as an entire group.

Physics majors used (a) problem set as the "Most frequently", and (b) tally sheet, portfolio, checklist and rubric as the "Least frequently" used assessment tools; Biology majors used (a) identification as the "Most frequently", and (b) tally sheet, portfolio, authentic task, journals, and checklist as the "Least frequently" used; Physical Science majors used (a) true-false test and identification as the "Most frequently", and (b) portfolio, and journals as the "Least frequently" used when grouped according to specialization.

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The findings also revealed that there was a significant difference in the use of rubric (p value=0.045) as the least frequently used assessment tool by pre-service teachers in science when grouped according to specialization. The significant difference occurred between Physics and Biology majors.

Assessment Tools	Frequency of used	Chi-Square	Df	Sig.	Interpretation
True-False Test	Most frequently	.832	2	.660	Not Significant
Identification	Most frequently	2.361	2	.307	Not Significant
Problem Set	Most frequently	5.655	2	.059	Not Significant
Tally sheet	Least frequently	2.548	2	.280	Not Significant
Portfolio	Least frequently	1.833	2	.400	Not Significant
Authentic task	Least frequently	.323	2	.851	Not Significant
Journals	Least frequently	1.033	2	.597	Not Significant
Checklist	Least frequently	3.033	2	.219	Not Significant
Rubric	Least frequently	6.222	2	.045	Significant

Legend:

df – Degrees of Freedom
Sig. – Significance

Index Range	Interpretation
<.05	Significant
>.05	Not Significant

The findings also showed that grading system of the pre-service teachers contributed to student performance that the difference in learning between them justifies giving different grades. Mostly unique grading components of pre-service teachers are 30% in quizzes, 20% in participation, 25% in periodical test, and 25% in the project. In addition, students' scores in the assessment tools and assessment strategy using chips to determine the points of students in their participation have greatly contributed to the grades of the students. On the other hand, the problems encountered by pre-service teachers in assessing student learning in science also reveals the following difficulties: (a) constructing question items in the test based on the table of specification, (b) matching the objective of the lesson with those in the assessment tool, (c) making effective distractors in a multiple-choice test, and (d) spending limited time in the construction of the test in order for the teacher to produce good assessment tools. Most of the critic teachers in the off-campus do not make use of authentic assessment because of the following difficulties encountered: (a) They lack of knowledge in checking authentic assessment tools, and (b) They prefer traditional assessment tools.

Implication to Research and Practice

This study shows that pre-service teachers in Science are more comfortable in using traditional types of assessment than authentic ones, but they are willing to use authentic types if they have time. However, the problem is the students' capabilities to answer these types of assessments. In teaching Science, pre-service teachers should challenge the conventional way of teaching. With the advent of technology, Science teachers need to shift to authentic assessment to enhance various types of learners, today's generation of students are hard to evaluate because of their different learning styles, hence a need for different approaches in assessing them.

The teachers as well as the students must not only be imprisoned in the four walls of the classroom, but explore the world for that is the role of education, to equip the students not only with knowledge but with experiences as well that will prepare them whenever they find jobs

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someday and help them face the challenge of the world. Teachers cannot just do this by traditional tools alone, thus the need to embrace new approaches which are called authentic assessment. With the use of these tools, students are provided with different cul-de-sacs where they can express themselves more. The problem is the way the students are graded. Teachers must remind themselves not to be biased and must be fair in assessing the learners. They must also remember that in choosing the tools to be used they must also consider the capabilities of students. What is important is that the tools used must cater to both slow and fast learners.

CONCLUSION

1.) When taken as an entire group, the most frequently used is "identification" and the least frequently used assessment tools are portfolio, journals, and checklist.

When grouped according to specialization, Physics majors (a) problem set as the "Most frequently" used, and (b) tally sheet, portfolio, checklist and rubric as the "Least frequently" used, Biology majors (a) identification as the "Most frequently" used, and (b) tally sheet, portfolio, authentic task, journals, and checklist as the "Least frequently" used, Physical Science majors (a) true-false test and identification are the "Most frequently" used, and (b) portfolio, and journals are the "Least frequently" used.

This implies that pre-service teachers are still a traditionalist means using traditional assessment most of the time in assessing student learning.

2.) There is a significant difference in rubric of 0.045 which is less than or equal to the significance level of 0.05 as the least frequently used assessment tool by student teachers in science when grouped according to specialization. The significant difference was determined in the mean difference of Physics and Biology majors. On the other hand, Physical Science majors have no significant difference among Biology and Physics majors. Using rubric as an authentic assessment tool in assessing student learning is not well utilized by pre-service teachers in science.

3.) Grading system of the student teachers contributed to student performance that the difference in learning between them justifies giving different grades. Mostly unique grading components of pre-service teachers are 30% in quizzes, 20% in participation, 25% in periodical test, and 25% in the project. Students' scores in the assessment tools and assessment strategy using chips to determine the points of students in their participation have greatly contributed to the grades of the students.

4.) The problems encountered by student teachers in assessing student learning in science are as follows: (a) constructing question items in the test based on the table of specification, (b) matching the objective of the lesson with those in the assessment tool, (c) making effective distractors in a multiple-choice test, and (d) spending limited time in the construction of the test in order for the teacher to produce good assessment tools. In addition, Most of the critic teachers in the off-campus do not make use of authentic assessment because of the following difficulties encountered: (a) They lack of knowledge in checking authentic assessment tools, and (b) They prefer traditional assessment tools.

This study shows that student teachers in Science are more comfortable using traditional types of assessment than authentic ones, but they are willing to use authentic types if they have the time. However, the problem is the students' capabilities to answer these types of assessments.

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Future Research

Looking at the outcome of the study, student teachers and instructors in the on-and-off campus ought to look for ways to develop authentic assessment in assessing student learning in science. In doing so, they are ensuring a good future for their students and at the same time improving the assessment in science education.

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